

CLAIMS

I claim:

- [c1] 1. An image sensor comprising:
a plurality of pixels formed in a semiconductor substrate, each pixel including a light sensitive element, said pixels grouped as a center portion of pixels and an outer portion of pixels;
a first set of micro-lenses formed over each of said pixels in said center portion of pixels; and
a second set of micro-lenses formed over each of said pixels in said outer portion of said pixels,
wherein said second set of micro-lenses differ from said first set of micro-lenses.
- [c2] 2. The image sensor of Claim 1 further including a color filter formed over each pixel, said color filter formed between said micro-lens and said light sensitive element.
- [c3] 3. The image sensor of Claim 1 further including a color filter formed over each pixel, said color filter formed over said micro-lens.
- [c4] 4. The image sensor of Claim 1 wherein the second set of micro-lenses are taller than said first set of micro-lenses.
- [c5] 5. The image sensor of Claim 1 wherein the second set of micro-lenses are larger than said first set of micro-lenses.
- [c6] 6. The image sensor of Claim 1 wherein said micro-lenses are formed from either polymethylmethacrylate (PMMA) or polyglycidylmethacrylate (PGMA).

- [c7] 7. The image sensor of Claim 1 further including an imaging lens coupled to said image sensor.
- [c8] 8. A method for forming an image sensor comprising:
forming a plurality of pixels in a semiconductor substrate, each pixel including a light sensitive element, said pixels grouped as a center portion of pixels and an outer portion of pixels;
forming a first set of micro-lenses over each of said pixels in said center portion of pixels; and
forming a second set of micro-lenses over each of said pixels in said outer portion of said pixels,
wherein said second set of micro-lenses differ from said first set of micro-lenses.
- [c9] 9. The method of Claim 8 further including forming a color filter over each pixel, said color filter formed between said micro-lens and said light sensitive element.
- [c10] 10. The method of Claim 8 further including forming a color filter over each pixel, said color filter formed over said micro-lens.
- [c11] 11. The method of Claim 8 wherein the second set of micro-lenses are taller than said first set of micro-lenses.
- [c12] 12. The method of Claim 8 wherein the second set of micro-lenses are larger than said first set of micro-lenses.
- [c13] 13. The method of Claim 8 wherein said micro-lenses are formed from either polymethylmethacrylate (PMMA) or polyglycidylmethacrylate (PGMA).

[c14] 14. The method of Claim 8 further including coupling an imaging lens to said image sensor.

[c15] 15. A method for forming an image sensor comprising:
forming a plurality of pixels in a semiconductor substrate, each pixel including a light sensitive element, said pixels grouped as a center portion of pixels and an outer portion of pixels;
forming a micro-lens material over said plurality of pixels, wherein said micro-lens material is a photoresist;
exposing said micro-lens material with a first reticle mask to generate gap sections in said micro-lens material;
exposing said micro-lens material with a second reticle mask to generate top portions in said micro-lens material located in said center portion of pixels;
developing said micro-lens material to remove said top portions and said gap sections;
reflowing said micro-lens material to form a first set of micro-lenses over each of said pixels in said center portion of pixels and a second set of micro-lenses over each of said pixels in said outer portion of said pixels,
wherein said second set of micro-lenses differ from said first set of micro-lenses.

[c16] 16. The method of Claim 15 further including forming a color filter over each pixel, said color filter formed between said micro-lens and said light sensitive element.

[c17] 17. The method of Claim 15 further including forming a color filter over each pixel, said color filter formed over said micro-lens.

[c18] 18. The method of Claim 15 wherein the second set of micro-lenses are taller than said first set of micro-lenses.

[c19] 19. The method of Claim 15 wherein the second set of micro-lenses are larger than said first set of micro-lenses.

[c20] 20. The method of Claim 15 wherein said micro-lens material is either polymethylmethacrylate (PMMA) or polyglycidylmethacrylate (PGMA).